

REMARKS

The Office Action dated January 21, 2004 has been received and carefully studied.

The Examiner rejects claims 7 and 18 under 35 U.S.C. §112, second paragraph, for various reasons. By the accompanying amendment, claim 7 has been amended to depend from claim 4. Claim 18 has been cancelled.

The Examiner rejects claims 1 and 16-17 under 35 U.S.C. §102(b) as being anticipated by Zachman et al., U.S. Patent No. 5,111,406.

The rejection is respectfully traversed.

The present invention relates to apparatus for adjusting the position between a multi-layered printed circuit board and a method of adjusting the position of a multi-layered printed circuit board. The alignment is between a printed circuit board and a photo mask. The mask mark 5 and the board mark 7 are used to position them. The mask mark 5 is visible and the board mark 7 is invisible. Accordingly, the present invention utilizes a projection screen, since the X-ray camera cannot be used because X-ray cameras cannot sense the visible mask mark. The projection screen can convert the X-rays into visible rays or ultra violet rays or infrared rays that can be sensed by usual CCD cameras.

Zachman utilizes the X-ray camera because Zachman handles only invisible board marks; Zachman aligns the invisible board marks using X-rays. There is no visible mask mark and Zachman does not have to treat both visible and invisible marks.

In addition, by the accompanying amendment, claim 1 has been amended by

incorporating therein limitations of claim 2, and claim 17 has been amended by incorporating therein limitations of claim 18. Claims 2 and 18 have been cancelled.

The Examiner rejects claims 2, 9, 10, 12, 14 and 18 under 35 U.S.C. §103(a) as being unpatentable over Smith, U.S. Patent No. 3,984,680, in view of Zachman et al.; claim 13 as being unpatentable over Smith in view of Zachman et al. and further in view of Tabarelli et al.; claim 5 as being unpatentable over Smith in view of Zachman et al., and further in view of Toth et al.; claim 7 as being unpatentable over Smith in view of Zachman et al., and further in view of Toth et al. and the known background information given by the applicant; and claim 8 as being unpatentable over Smith in view of Zachman et al., and further in view of Toth et al. and further in view of Koymayama.

The Examiner states that Smith discloses an alignment method to align one of several masks relative to a substrate by emitting soft x-rays such that the x-rays pass through multiple alignment marks 13 on a mask 22 and also an alignment mark 15 on a substrate 14 and are imaged onto a fluorescence detector 17. The fluorescence detector converts the x-rays into a visible indication that is used to implement the substrate motion system 21. The Examiner admits that Smith does not disclose that a multi-layered circuit board can be produced, but notes that Smith does disclose that soft x-ray lithography is an effective and convenient means of fabricating microelectronic devices. The Examiner cites Zachman et al. for its disclosure of the production of multi-layered circuit boards that include a plurality of insulated layers and a plurality of conductive layers having a conductive pattern. The Examiner concludes that it would have been obvious to combine Smith and Zachman in order to obtain an apparatus for producing a multi-layered circuit

board in accordance with these claims. Tabarelli is cited as disclosing a projection lens that is used to direct a lithography pattern onto a circuit for higher resolution. Toth is cited as disclosing an x-ray irradiation device and adjustment or correction of the position of the x-ray beam. Koymayama is cited for its disclosure of an adjustable alignment apparatus system that uses x-rays to align a wafer and a mask.

The rejections are respectfully traversed.

Smith discloses a soft X-ray mask alignment system that uses board marks and mask marks to align the board and the mask. However, Smith is otherwise very different from the present invention. X-rays are used to emit the fluorescent X-rays, the intensity of which indicates the proximity of the board marks and the mask marks. Smith does not include a projection screen to convert invisible rays into visible rays (with CCD cameras) so that the alignment of the visible mark and the invisible mark can be conducted using CCD cameras, as in the present invention. As discussed above, Zachman et al. do not disclose or suggest this deficiency of Smith. Similarly, none of Tabarelli et al., Toth et al. or Koymayama disclose or suggest this deficiency.

The Examiner rejects claims 3 and 20 under 35 U.S.C. §103(a) as being unpatentable over Zachman et al. in view of Ito, U.S. Patent No. 5,028,520. The Examiner admits that Zachman does not disclose a fluorescent screen, and cites Ito as disclosing this feature.

Claims 3 and 20 are believed to be allowable by virtue of their dependence, for the reasons discussed above. Moreover, the skilled artisan would have no reason to use a fluorescent screen in the apparatus of Zachman et al.

The Examiner rejects claim 4 under 35 U.S.C. §103(a) as being unpatentable over Zachman et al. in view of the known background information provided by the applicant. The Examiner admits that Zachman does not explicitly disclose that there is a core board in the multiple layered board and that it contains solder marks, but the Examiner relies upon the statement in the instant specification that multi-layered printed circuit boards have a core board with conductive patterns.

Claim 4 is believed to be allowable by virtue of its dependence, for the reasons discussed above.


The Examiner rejects claims 15 and 19 under 35 U.S.C. §103(a) as being unpatentable over Zachman et al. in view of Melcher et al., U.S. Patent No. 4,504,727. The Examiner cites Melcher et al. for its disclosure of a method for drilling a hole in a multi-layered circuit board by focusing a laser on the drill point.

Claims 15 and 19 are believed to be allowable by virtue of its dependence, for the reasons discussed above.

The Examiner's indication that claims 6 and 11 contain allowable subject matter is noted with appreciation.

Reconsideration and allowance of all of the claims are respectfully requested in view of the foregoing amendment and remarks.

Respectfully submitted,


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